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(54) Title: INSECT CONTROL MAT

(57) Abstract: An insect control mat having a heatable substrate; an insect control active material; and an aversion material in an amount effective to cause a person to avoid retaining the mat in the person's mouth. A method of controlling insects by use of such a mat is also disclosed.

## Insect Control Mat

## BACKGROUND OF THE INVENTION

5           The present invention relates to insect control and specifically to insect control mats, typically for use with heaters.

          Insect control mats for use with heaters or moving air are well known in the art. The mats are typically made of absorbent, heat-resistive materials. They are treated with insect control active materials and are then placed on heaters of various sorts or in blower  
10        devices. The active ingredients are chosen to be such that an effective amount of insect control is achieved by release of the insect control active materials under the heat or moving air use conditions.

          It is known that children, pets, and the like will sometimes chew or ingest non-food items. Insect control mats appear not to have caused toxicity problems around children or  
15        pets, perhaps because of relatively low concentrations of insect control active materials, the generally non-inviting appearance of the mats or the heaters, or for other reasons. However, new uses for mats, especially for outdoor insect control, have led to the introduction of mats having high amounts of active ingredients, amounts sufficiently high that a child or animal could suffer undesirable effects if such a mat were eaten.  
20        Furthermore, such mats are sometimes intend for use in attractive devices that are more likely to be placed on table tops and in other areas where a child's interest might be sparked.

          It can therefore be seen that there is a newly important need for an improved insect control mat made to discourage children or animals from keeping the mat in their mouths.

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## BRIEF SUMMARY OF THE INVENTION

          The following definitions apply throughout. An "aversion material" is a chemical or mixture of chemicals, whether synthetic or naturally occurring, that, when present in or  
30        on a substance in non-toxic amounts, will cause a person to avoid retaining the substance in the person's mouth. A "non-toxic amount" of a material is defined as an amount that can be held in a person's mouth and then expelled without a negative effect on the health of the person. A "bittering agent" is an aversion material that causes a repellingly bitter taste

when placed in the mouth in non-toxic amounts. A "spicy repellent" is an aversion material other than a bittering agent that causes a repelling heat, spicy pain, or revolting taste when placed in the mouth in non-toxic amounts.

"Insect" means actual insects and also arthropods and other small animals commonly controlled by the same means used to control insects. An "insect control active material" is an insecticide, an insect repellent, or other material that causes modifications in insect behavior or development. An insect control active material is "volatile" if it evaporates in effective amounts under the intended conditions of use, the parameters of such conditions of use including but not limited to temperature and air flow. An "insect control mat" is a substrate of a selected material that bears or incorporates a volatile insect control material. Insect control mats are commonly available for use with heaters of various sorts and are impregnated with or otherwise contain or support an insect control material that is driven off by heat or moving air in amounts effective to repel or otherwise control flying insects. An amount of a material is an "effective amount" if it is sufficient to have the intended effect. An insect control material will be understood as being "toxic" if it causes undesirable symptoms in a person or domestic animal when consumed in the amount present in an insect control mat. "Undesirable symptoms" can include but are not limited to merely unpleasant sensations.

The invention provides an improved insect control mat that includes a heatable substrate, an insect control active material, and an aversion material in an amount effective to cause a person to avoid retaining the mat in the person's mouth. Preferably, the aversion material is selected from the group consisting of bittering agents, spicy repellents, and combinations thereof. More preferably, the aversion material is selected from the group consisting of denatonium benzoate, denatonium saccharide, denatonium chloride, sucrose benzoate, quinine, quinine hydrochloride, quinine sulfate, brucine, brucine sulfate, quassia, naringin, limonin, phenylthiocarbamide, quebracho, sucrose octaacetate, quassin, quercetin, berberine, and combinations thereof. For reasons of cost and effectiveness, denatonium benzoate is the most preferred aversion material.

Many parents would prefer, if only to be very conservative, that their children not ingest insect control materials from insect mats, even in quantities that in fact will do no harm. Although the invention therefore is beneficial even with amounts of insect control active ingredient insufficient actually to be toxic to the average person, the invention is most beneficial when the insect control active ingredient is present in an amount sufficient

to be toxic if ingested by a human or domestic animal. For example, the insect control active material d-allethrin (ISO-registered name), is commonly used in insect control mats in amounts of about 50mg per mat, an amount that appears not to present practical toxicity problems. However, mats prepared for certain uses can contain at least 90mg of d-

5 allethrin. It is believed to be important that children be deterred from keeping such mats in their mouths.

The insect control active material present in the mat of the invention preferably is selected from the group consisting of d-allethrin, allethrin, prallethrin, bioallethrin, s-bioallethrin, esbiol, dichlorvos, transfluthrin, pyrethrum, and combinations thereof. The

10 insect control active materials just referred to by their ISO registered names are further identified as follows:

Table 1

ISO registered name	Commercial name or trademark
d-allethrin	Pynamin Forte® (Sumitomo)
allethrin	Pynamin® (Sumitomo)
prallethrin	Etoc
bioallethrin	
s-bioallethrin	Esbiothrin (available from AgrEvo Environmental Health, Inc.)
esbiol	
dichlorvos	DDVP
pyrethrum	natural chrysanthemum extracts
transfluthrin	

All of these materials are of proven effectiveness against insects when used in

15 insect control mats. Particularly preferred insect control active materials are d-allethrin, prallethrin, s-bioallethrin, allethrin, dichlorvos, and combinations thereof, and most preferred is d-allethrin in a total amount greater than or equal to 50mg. For certain applications, d-allethrin in a total amount greater than or equal to 90mg is preferred, with an amount greater than or equal to 250mg being ideal, including amounts as high or higher

20 than 600mg. The higher amounts of d-allethrin are used in volatile dispensers in which the insect control mat is suspended above the flame of a candle, lamp, or the like, within the

chimney of a hurricane lamp-type of device. Preferably the mat is held with an edge of the mat presented toward the flame so that hot gases flow over opposite sides of the mat.

In a preferred embodiment, the heatable substrate of the insect control mat is made of a material selected from the group consisting of matted fibrous materials, ceramic materials, a contained gel, and a polymeric material. When matted fibrous materials are used, a preferred material includes matted cellulosic materials.

In an alternative embodiment, the heatable substrate is a gel that contains the insect control material, the gel being contained within a heat-resistant cup, preferably a cup made of metal or heat-resistant plastic. The gel can be contained within the cup by a volatile-permeable membrane. See e.g. U.S. patent 5,645,845 for an example of gel-based systems. (The disclosure of this patent and all patents and publications cited herein is incorporated herein by reference as if fully set forth.) A silica gel is preferred, such as that commercially available under the trade name Cabosil.

Alternatively, the heatable substrate can be a polymeric material impregnated with the insect control material. Examples of such polymeric materials are disclosed in European Patent Application No. 94830104.91 (Publication number 0 671 123 A1). Preferred is the block co-polymer comprising an elastomeric polymer and a stiff polymer, such as a polyether-polyamide co-polymer, as disclosed therein.

The method of the invention for controlling insects includes the following steps. First, an insect control mat is provided that has a heatable substrate; an insect control active material; and an aversion material in an amount effective to cause a person to avoid retaining the mat in the person's mouth. Then, the insect control mat is exposed to heat sufficient to release an amount of the insect control material effective to control insects.

## BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is an insect control mat of a shape commonly commercially available for use with heater devices.

## DETAILED DESCRIPTION OF THE INVENTION

Turning now to the drawing, an insect control mat of a shape commonly commercially available is shown generally at 10 in Fig. 1. The typical mat 10 shown is

generally flat and rectangular with a typical thickness on the order of 0.5 to 6mm, with a thickness of 0.9 to 3mm being more common. However, curved, cylindrical, fan-folded, and many other geometries are also possible (not shown). The invention is not limited to any particular mat geometry. Mat 10 has an upper side 12 and an under side (not shown).

5       The mat 10 is most commonly made of a matted or felted cellulosic material. Cotton, fiberglass, and other alternative, matted fibrous materials are also possible, as are porous ceramic materials, contained gels, and polymeric materials. All of these materials are examples of heatable substrates capable of supporting an insect control material to be dispensed. The invention is not limited to just the exemplary materials listed.

10       The mat 10 is impregnated, coated, or otherwise loaded with an insect control material. The insect control material thus can either permeate the mat 10 or reside on the surface of either the upper or under side. The insect control material is present in an amount such that, when the mat 10 is exposed to the desired amount of heat, an amount of the insect control material is released that is effective to control insects. The mat 10 also is  
15       impregnated, coated, or otherwise loaded with an aversion material in an amount effective to cause a person to avoid retaining the mat in the person's mouth. Such insect control and aversion materials can be loaded onto the mat 10 by being sprayed in liquid form, being deposited as a dose of liquid applied to the mat, or being applied by dipping, wet roller, or any other of the conventional ways to treat such mats. Dose deposition in the center of the  
20       mat, followed by the wicking of the dose throughout the mat, is preferred.

      Examples of insect control mats made in accordance with the invention are as follows. The chemical ingredients listed are combined to form a liquid preparation and then are loaded on the mat in liquid form, preferably by dose deposition in the center of the mat. Then the mat is promptly enclosed within a sealed envelope or other container,  
25       whereupon the liquid is allowed to wick throughout the mat.

      In the formulations, below, "yoshinox" is a common anti-oxidant (2,2'-methylene bis (6-tert-butyl-4-ethyl-phenyl)); and Isopar M is a hydrocarbon solvent sold by Exxon Chemical Company. Isopar M and ethanol function as solvents in each example. Isopropyl myristate is a solubilizer. CI Solvent Blue 35 is an optional, inert colorant.  
30       Amounts are in weight percents.

Example 1: (Preferred embodiment)

Ingredient	(% w/w)
d-cis/trans allethrin (technical grade)	23.75
Yoshinox	2.73
CI Solvent Blue 35	0.13
Isopropyl myristate	0.17
Isopar M	9.08
Ethanol	1.16
Denatonium Benzoate	0.50
Cellulose mat	62.49
Total	100.00

Example 2: (Hypothetical)

Ingredient	(% w/w)
Allethrin	30.97
Yoshinox	1.29
CI Solvent Blue 35	0.06
Isopropyl myristate	0.08
Isopar M	4.30
Ethanol	0.61
Denatonium Saccharide	0.18
Cellulose mat	62.50
Total	100.00

## Example 3: (Hypothetical)

Ingredient	(% w/w)
Prallethrin	11.65
Yoshinox	3.76
CI Solvent Blue 35	0.18
Isopropyl myristate	0.23
Isopar M	12.51
Ethanol	7.06
Denatonium Chloride	2.12
Cellulose mat	62.5
Total	100

## Example 4: (Hypothetical)

Ingredient	(% w/w)
s-bioallethrin	6.63
Yoshinox	1.07
CI Solvent Blue 35	0.05
Isopropyl myristate	0.07
Isopar M	3.56
Ethanol	20.09
Quinine (or Quinine Hydrochloride or Quinine Sulfate)	6.03
Cellulose mat	62.50
Total	100.00



Example 5: (Hypothetical)

Ingredient	(% w/w)
Prallethrin	23.89
Yoshinox	0.42
CI Solvent Blue 35	0.02
Isopropyl myristate	0.03
Isopar M	7.96
Ethanol	3.98
Brucine (or Brucine Sulfate)	1.19
Cellulose mat	62.5
Total	100

Example 6: (Hypothetical)

Ingredient	(% w/w)
Prallethrin	6.92
Yoshinox	0.74
CI Solvent Blue 35	0.04
Isopropyl myristate	0.05
Isopar M	2.48
Ethanol	20.98
Naringin	6.29
Cellulose mat	62.5
Total	100

Example 7: (Hypothetical)

Ingredient	(% w/w)
Prallethrin	2.93
Yoshinox	2.08
CI Solvent Blue 35	0.10
Isopropyl myristate	0.13
Isopar M	6.91
Ethanol	19.50
Sucrose Benzoate	5.85
Cellulose mat	62.5
Total	100

Example 8: (Hypothetical)

Ingredient	(% w/w)
Prallethrin	2.50
Yoshinox	1.78
CI Solvent Blue 35	0.09
Isopropyl myristate	0.11
Isopar M	5.91
Ethanol	20.86
Sucrose Octaacetate	6.26
Cellulose mat	62.5
Total	100

Example 9: (Hypothetical)

Ingredient	(% w/w)
Prallethrin	12.30
Yoshinox	0.87
CI Solvent Blue 35	0.04
Isopropyl myristate	0.05
Isopar M	2.91
Ethanol	16.40
Quassin	4.92
Cellulose mat	62.5
Total	100

Example 10: (Hypothetical)

Ingredient	(% w/w)
Prallethrin	9.58
Yoshinox	0.68
CI Solvent Blue 35	0.03
Isopropyl myristate	0.04
Isopar M	2.26
Ethanol	19.16
Quercetin	5.75
Cellulose mat	62.5
Total	100

## Example 11: (Hypothetical)

Ingredient	(% w/w)
Prallethrin	12.30
Yoshinox	0.87
CI Solvent Blue 35	0.04
Isopropyl myristate	0.05
Isopar M	2.91
Ethanol	16.40
Berberine	4.92
Cellulose mat	62.5
Total	100

The preceding description is merely of preferred embodiments of the invention. One skilled in the art will readily apprehend alternative embodiments that nevertheless fall within the scope and breadth of the invention. Thus, the claims should be looked to in order to understand the full scope of the invention.

## INDUSTRIAL APPLICABILITY

An insect control mat has been disclosed effective for use with a heater for the control of insects and treated to discourage ingestion by pets or misuse by children or other persons.

## CLAIMS:

1. An insect control mat comprising:
  - a. a heatable substrate;
  - 5 b. an insect control active material; and
  - c. an aversion material in an amount effective to cause a person to avoid retaining the mat in the person's mouth.
- 10 2. The insect control mat of claim 1 wherein the aversion material is selected from the group consisting of bittering agents, spicy repellents, and combinations thereof.
3. The insect control mat of claim 1 wherein the aversion material is selected from the group consisting of denatonium benzoate, denatonium saccharide, denatonium chloride, sucrose benzoate, quinine, quinine hydrochloride, quinine sulfate, brucine, brucine sulfate,  
15 quassia, naringin, limonin, phenylthiocarbamide, quebracho, sucrose octaacetate, quassin, quercetin, berberine, and combinations thereof.
4. The insect control mat of claim 2 wherein the insect control active ingredient is present in an amount sufficient to be toxic if ingested by a human or domestic animal.  
20
5. The insect control mat of claim 1 wherein the insect control active material is selected from the group consisting of d-allethrin, prallethrin, s-bioallethrin, allethrin, dichlorvos, transfluthrin, pyrethrum, and combinations thereof.
- 25 6. The insect control mat of claim 5 wherein the insect control active is selected from the group consisting of d-allethrin, prallethrin, s-bioallethrin, allethrin, and combinations thereof.
7. The insect control mat of claim 6 wherein the insect control active is d-allethrin in a  
30 total amount greater than or equal to 50mg.
8. The insect control mat of claim 6 wherein the insect control active is d-allethrin in a total amount greater than or equal to 90mg.

9. The insect control mat of claim 6 wherein the insect control active is d-allethrin in a total amount greater than or equal to 250mg.
- 5 10. The insect control mat of claim 1 wherein the heatable substrate is made of a material selected from the group consisting of matted fibrous materials, ceramic materials, a contained gel, and a polymeric material.
11. The insect control mat of claim 10 wherein the matted fibrous materials include  
10 matted cellulosic materials.
12. The insect control mat of claim 10 wherein the contained gel includes a silica gel contained within a heat resistant cup.
- 15 13. A method of controlling insects comprising the steps of:
- a. providing an insect control mat having a heatable substrate; an insect control active material; and an aversion material in an amount effective to cause a person to avoid retaining the mat in the person's mouth; and
  - b. exposing the insect control mat to heat sufficient to release an amount of the  
20 insect control material effective to control insects.

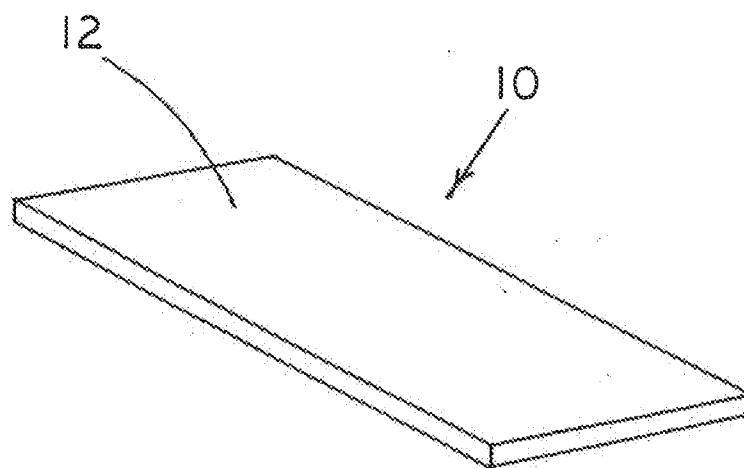


FIG. 1

# INTERNATIONAL SEARCH REPORT

International Application No  
PCT/US 00/33823

<b>A. CLASSIFICATION OF SUBJECT MATTER</b> IPC 7 A01N25/18	
According to International Patent Classification (IPC) or to both national classification and IPC	
<b>B. FIELDS SEARCHED</b> Minimum documentation searched (classification system followed by classification symbols) IPC 7 A01N	
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched	
Electronic data base consulted during the international search (name of data base and, where practical, search terms used) EPO-Internal, WPI Data, PAJ, BIOSIS	
<b>C. DOCUMENTS CONSIDERED TO BE RELEVANT</b>	
Category *	Citation of document, with indication, where appropriate, of the relevant passages Relevant to claim No.
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X	EP 0 920 860 A (SHOWA DENKO KK) 9 June 1999 (1999-06-09) paragraph '0035! - paragraph '0037! 1-13
X	EP 0 904 771 A (SHOWA DENKO KK) 31 March 1999 (1999-03-31) paragraph '0032! - paragraph '0034! 1-13
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<input checked="" type="checkbox"/> Further documents are listed in the continuation of box C.	
<input checked="" type="checkbox"/> Patent family members are listed in annex.	
* Special categories of cited documents : *A* document defining the general state of the art which is not considered to be of particular relevance *E* earlier document but published on or after the international filing date *L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) *O* document referring to an oral disclosure, use, exhibition or other means *P* document published prior to the international filing date but later than the priority date claimed *T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention *X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone *Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art *Z* document member of the same patent family	
Date of the actual completion of the international search 15 March 2001	Date of mailing of the international search report 21/03/2001
Name and mailing address of the ISA European Patent Office, P.B. 5818 Patentbau 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax (+31-70) 340-3010	Authorized officer Bertrand, F



# INTERNATIONAL SEARCH REPORT

Int. Patent Application No  
PCT/US 00/33823

## C. (Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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Information on patent family members

In International Application No

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